

MALE AGGREGATIONS AND MATING FLIGHT IN *TETRAGONISCA ANGUSTULA* (HYMENOPTERA, APIDAE, MELIPONINAE)¹

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ABSTRACT

During the swarming process in *Tetragonisca angustula* Latreille, 1811 male aggregations were observed in the proximities of the daughter colony that was being formed. The aggregations initiated before the queen migrated to the new colony. The arrival of the queen at the new colony, and the time and duration of the mating flight are described.

KEYWORDS. Apidae, Meliponinae, male aggregations, mating flight.

INTRODUCTION

The unique characteristic of the Meliponinae, which is related to male reproductive strategy, is the formation of male aggregations in the vicinity of the colonies. First reported by MICHENER (1946) and NOGUEIRA-NETO (1954), this behavior has been observed in several species, including *Trigona fulviventris* Guérin, 1835, *Scaura latitarsis* Friese, 1900, *Nannotrigona testaceicornis* Lepeletier, 1836, *Tetragonisca angustula* Latreille, 1811 (MICHENER, 1946), *Scaptotrigona postica* Latreille, 1807 (KERR et al., 1962) and *Tetragona dorsalis* Smith, 1854 (ROUBIK, 1990). Male aggregations are characterized by highly visible male activity and are extremely easy to locate since thousands of individuals fly or rest close to the colony. They can be found nearby the colonies in two distinct situations: during the queen replacement process or during the swarming process. In the latter case, the presence of males is always observed in front of the daughter colony.

This paper reports the formation of males aggregations and the mating flight during swarming processes in *Tetragonisca angustula* Latreille, 1811, popularly known in Brazil as the "Jataí" bee.

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MATERIAL AND METHODS

Male aggregations and mating flights were studied by direct observation of *Tetragonisca angustula* daughter colonies during swarming processes, in Ribeirão Preto (21°11'25"S - 47°43'W) Campus of the University of São Paulo, Ribeirão Preto, São Paulo, Brazil. Seven swarming processes were observed during the months of January, February, March, May, June and August of 1991 and September of 1992. The daughter colonies in formation were observed for five hours on a daily basis. Voucher specimens were deposited in the collection of Dr. João Maria Franco de Camargo (Faculdade de Filosofia Ciências e Letras de Ribeirão Preto, Universidade de São Paulo, Ribeirão Preto, São Paulo, Brazil).

RESULTS

In the swarming processes of *Tetragonisca angustula* male aggregations were encountered nearby the daughter colony. The number of individuals flying or resting on vegetation or constructions near the colony varied between ten to thousands, according to the phase of the swarming process. When resting, the males always exhibited bodies slightly bended upward in relation to the substrate, raised antennae, constant up and down motion of their abdomen and rubbing their hind legs laterally against the abdomen.

In four out of seven cases the beginning of the male aggregation process was observed. Aggregation was started near the colony about three days after the beginning of swarming and in all cases this occurred before the arrival of the queen at the daughter colony. The first males started to arrive at the daughter colony at about 9:00 a.m. and disappeared by the end of the afternoon, at about 5:00 p.m. As the activities of daughter colony preparation increased (construction of the involucre and food pots, and food transportation) an increasing number of males was observed in the aggregation. No aggressive interactions between males and workers were observed and they did not occupy individual territories. The virgin queen arrival was accompanied by a "cloud of workers" which moved from the mother to the daughter colony. On average, the queen migrated 4.5 days (n=6) after the arrival of the first males. After the arrival of the queen, the population inside the colony was twice as large as that observed at the beginning of the process, and the male aggregation was highly agitated.

In one occasion, the presence of two virgin queens inside the daughter colony was observed. One of them moved agitatedly around near the involucre and the other remained at the back of the nest, where she was attacked by workers who bit her and placed resin pellets on her body. On the following day, this queen was found to be partially covered with resin, with its head and wings torn from the body.

In five of the processes studied, the queen left the nest for the mating flight on the same day of her arrival at the new colony, and in the other two, she left the nest one day later. A few minutes before the queen left for the mating flight, male agitation was quite intense, with drones flying in circles in front of the nest.

Three nuptial flights were timed at: 1min 45sec, 1 min 53sec and 2min 23sec, respectively. They all happened around 12:00 a.m. In one case, when the queen left the colony for the mating flight she flew in front of the nest, about 50 cm from the tube, performing an "orientation flight", after which she flew through the male aggregation and all the males followed her. At the site where mating occurred (12 cm from the nest and about 11m above the ground), a "male cloud" formed, with individuals flying in circles. The males started to return to the area surrounding the nest 1min and 45sec

after the queen had returned from her mating flight. On the days following the mating flight, the number of males in the aggregation decreased gradually and disappeared between the third and fourth day after mating.

DISCUSSION

The attractiveness of the virgin queen is related to workers and is male age dependent (IMPERATRIZ-FONSECA, 1977; SIMÕES & BEGO, 1979). According to ENGELS *et al.* (1990), the formation of male aggregations is directly related to chemical communication that takes place between males and workers. In contrast, ENGELS & ENGELS (1988) suggested that males are attracted by the sex pheromone of females, which is species specific. This scent must be dispersed by foraging workers, which keep contact with the attractive virgin queen, acting as messengers in the field. With this mechanism, the males can follow these trails and locate the colonies containing a virgin queen (ENGELS & IMPERATRIZ-FONSECA, 1990). ROUBIK (1990) suggested that males may maintain a mutual relationship, returning to their nests of origin where they probably recruit other males throughout their pheromone in order to form an aggregation.

During the phase in which the aggregations are composed of thousands of males, overlapping in the landing area starts to occur, however, even under these conditions there are no aggressive interactions amongst the males. On the other hand, the formation of agonistic subgroups have been observed during male aggregation of *Melipona favosa* Fabricius, 1789 (SOMMEIJER & BRUIJN, 1995).

It has been reported that the population level of the colony increases after the arrival of the queen (DARCHEN, 1977; INOUE *et al.*, 1984). Our observations agree with those of INOUE *et al.* (1984) which suggest that there is an adjustment in the numbers of individuals in the daughter colony, since the change in the number of workers inside the nest is quite visible.

The aggregation behavior of males around certain nests has been described for many meliponine species, all of them, however, belonging to the tribe Trigonini. According to ENGELS & IMPERATRIZ-FONSECA (1990), the short duration of the mating flight is directly related to the presence of males aggregates near the colonies. This would explain the long mating flights reported for *Melipona quadrifasciata* Lepageletier, 1936 (KERR *et al.*, 1962), since there are no reports of male aggregations close to the colonies of this species. In *Melipona favosa* Fabricius, 1789, SOMMEIJER & BRUIJN (1995) observed a drone congregation area distant from the nest.

During development there is a change in the level of pheromone released by the queen. This alteration may explain the gradual disappearance of males from the surroundings of the newly formed colony after the queen fecundation. According to ENGELS *et al.* (1990) during this phase, the amount of pheromone released by the queen is probably not attractive to males.

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